Transforming Intel factories from global presence to Global Operation!

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Abstract – The collective output of multiple high volume factories located around the world has enabled Intel to satisfy the enormous demand requirements of customers worldwide. Despite this excellent strategic advantage, the time zone and workday differences have largely hindered cross-factory cooperation at the operational level. The Global Operation concept transforms this cooperation barrier into a strategic advantage by sharing resources to improve engineering support of Intel's global manufacturing operation. Since Intel has factories positioned around the globe, engineering support follows the sun, greatly reducing the number of hours when engineering support is not available at Intel. Engineers normally charted to ensure uptime at a local factory are now ensuring uptime across Intel factories worldwide. Night and weekend events that would normally wait until the next business day for resolution, are now being solved immediately by an on-site engineer at a sister factory on the other side of the world.

The Global Operation concept capitalizes on E-Manufacturing concepts and Intel's "Copy Exactly Methodology," which ensure that factories have virtually identical infrastructure. Downtime events that require engineering support can be handled by engineering support from any of Intel's identical factories. Downtime incidents are automatically routed to the appropriate engineer worldwide. It also gives them the ability to remotely access and control tools from other factories. This technology allows virtually any issue that requires engineering support to be solved remotely.

A downtime event includes any event that impacts the output of the factory including those related to equipment, process, yield, software and hardware. Typically, to reduce the potential downtime impact, downtime events are handled by engineers on-call. While this approach is usually effective, it can also be a significant burden on engineers resulting in excessive attrition. This is a significant concern since the retention of these key contributors is a high priority. Global Operations concept helps to alleviate this burden by reducing the number of hours on-call engineers need to handle downtime events. Other benefits include redundant sets of specialized engineers and improved synergy among factories. The concept is being expanded into many different engineering functions and among additional factories to further increase the hours of on-site engineering coverage. Intel has shown that engineers can effectively resolve manufacturing downtime events in other factories using the Global Operations concept.

This paper describes the benefits and challenges involved with implementing this concept at Intel.

Index Terms – Global, Factory, Operation

INTRODUCTION

Global Operations is a new operational methodology for collective support of geographically dispersed manufacturing operations. A local downtime incident impacts the global output of the corporation, however, the typical operational model only charters local engineers to support a local factory. Global Operations puts a global priority on Local downtime incidents. These local downtime incidents that occur during nights and weekends are a heavy burden on local engineers. They often occur at inconvenient times and take a significant amount of time to resolve. Meanwhile, a capable engineer at an Intel site on the other side of the globe is available to solve these urgent issues. Local engineering support is on-site only about 45 hours per week, but with the Global Operations model, this increases the number of on-site support hours to 90+ hours per week!

Copy Exactly, an Intel business process which ensures that our factory environments are virtually identical, enabled this concept. Global Operations is the next logical progression of Copy Exactly. Local downtime issues are given global attention and priority and geographically dispersed organizations are working together on a daily basis. The purpose of this paper is to promote this concept.

Intel's Fab 12 in Arizona USA and Fab 18 in Israel, have been using the Global Operations concept for three quarters with great success. This paper is based on this success story.

GLOBAL DIFFERENCES

Intel is a highly productive international company that has learned to overcome language and cultural differences among its global factories. Despite this significant accomplishment, the time zone differences continue to inhibit cooperation between Intel factories. Cross-factory meetings, which are a good way to bridge communication gaps, are a heavy burden since they require some of the global participants to either come to early or stay at work late. This conflict with the employee's personal time can become a major barrier to cooperation.

ENGINEERING SUPPORT GAPS

Intel operates its factories 24 hours a day seven days a week, however, since engineers are typically at Intel only during the weekdays there are major gaps in engineering support.

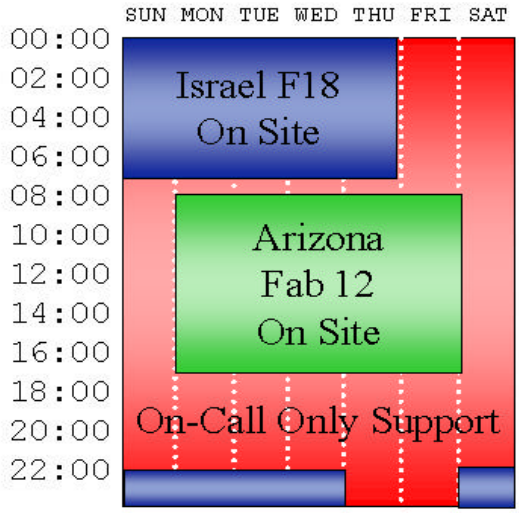
THE ON-CALL SOLUTION

Many engineering groups provide 24x7 support for factories by placing their engineers "On-Call." The engineers are expected to provide immediate response regardless of the time of day. Overall, Intel has enjoyed significant success in keeping factories running 24x7 with "On-Call." Engineers are financially compensated for providing this type of support, however, it can upset one's work/life balance if the volume is significant. Furthermore, getting support from "sleepy engineers" may not be adequate.

THE GLOBAL SOLUTION

The Sun is always shining on an Intel Factory. Why not have issues follow the Sun and get help from another Intel factory during nights? These global engineers are alert and able to provide remote engineering support.

The graph below shows the normal work hours for US engineers are Monday through Friday 8am to 5pm. Engineering support is available to the factory only about 45 hours per week.



Graph 1. Hours of Coverage

Ten time zones away in Israel, the work week is from Sunday to Thursday 8am to 5pm which means that there is no normal work hour overlap between the US and Israel. Although this makes cross-factory meetings inconvenient for both sides, with Global Operations, it also effectively doubles the amount of on-site engineering support. This of course will increase as you add more factories to the support model.

HOW IT WORKS

A Global Operations Support Center web site is used to route and manage downtime incidents. Factory technicians can escalate a downtime incident

at any time by typing in the issue on this web site. In the example below, it is night in the US and day in Europe. Any incident escalated now will route the incident automatically to an engineer in Europe (Israel).

Figure 1 – Global Operations Web Site

When it is night in Israel and day in the US, the incident will be routed automatically to the US. In other cases when it is off work hours in both factories, the incident will be routed to the local on-call engineer. Regrardless, the factory technician gets a prompt response from a qualified engineer.

Figure 2 – Screen shot of remote tool access

The global and local engineer can use E-Manufacturing concepts like using remote access software to control factory equipment as shown below.

GLOBALOPERATIONS IN ACTION

Intel's Fab 12 in Arizona USA and Fab 18 in Israel have been using the Global Operation concept since October 1999 in the Wafer Sort functional area. The Global Operations project was extremely successful as it demonstrated that it is possible to provide effective shared support of global dispersed factories. Global engineers were also able to solve remote issues without impacting local priorities. Many other beneifits were observed during the implementation. Data was carefully collected to measure the program impact and effectiveness.

Each incident was classified as follows:

Global – Incidents handled by Global Operations
On-Call – Incidents handled by local On-Call
Local Call – Local call during regular Work Week

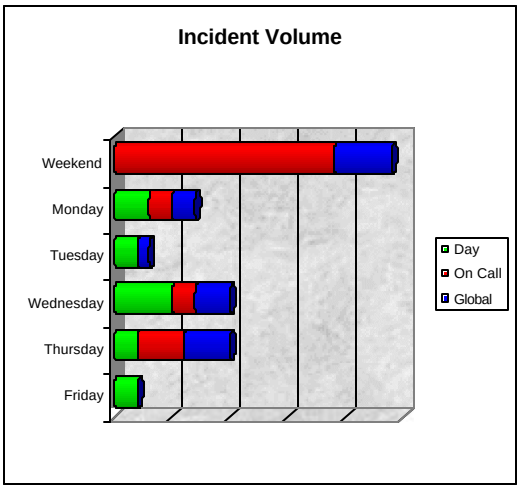


Figure 3 – Distribution of Incidents during week

Since two factories only cover 90 out of the 168 work week hours, the majority of the incidents were still handled by On-call especially on weekends. During the weekends global engineers were able to give on-call engineers some relief by solving about 1/4th of the incidents. During the week, however, about half the incidents were handled by global engineers.

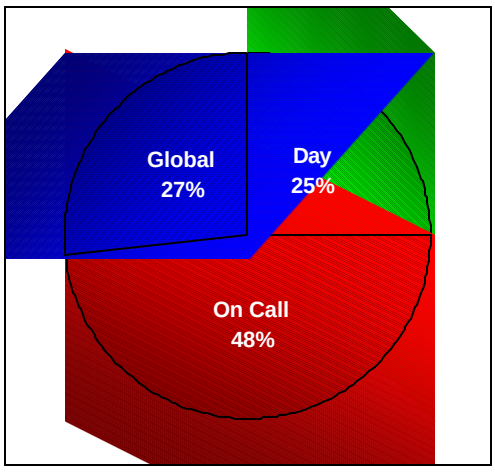


Figure 4 – Distribution of incidents by type

Getting support from alert engineers means the response time thus improving manufacturing

readiness and creating a better quality of life for the engineers.

EXTENDED DOWNTIME

Global Operations not only reduced stress to on-call support, but it also reduced the risk of extended downtime. For example, a Thursday night incident in Israel could wait until Sunday morning for resolution. This type of extended downtime could result in missed customer commitments. With Global Operations, the factory downtime incident could be solved immediately.

LOCAL PRIORITIES

Global incidents had only a minimal impact on local priorities due to a strict escalation policy and by dedicating one person from each factory to handle global calls all week. Only incidents that impacted the processing of material could be escalated to a global engineer. Each factory would also dedicate one person to handle all global incidents each week. This allowed the rest of the team to concentrate on local priorities.

INFRASTRUCTURE SYNERGY

Despite Intel's vigorous effort to implement its factories exactly the same, subtle differences between sites continue to exist. It is difficult to support multiple factories where there are differences, so this project highlighted these differences. The result was better infrastructure synergy and a more repeatable environment.

PEOPLE SYNERGY

An unexpected benefit of this effort was the people synergy. The relationship of global engineering teams is often strained due to the time zone challenges involved with working together. This project fostered close alliances between these teams resulting in better cooperation and synergy.

QUALITY OF LIFE

The hours of coverage was contributed to the quality of life for on-call engineers. For engineers in the US, global Israeli engineers handled incidents from midnight until 8am allowing them to get a good night's sleep. For engineers in Israel, they could be rely on global American engineers to solve problems from 5pm until midnight allowing them to enjoy personal time before going to bed. This made being on-call less stressful.

OUT OF PLANT IMPACT

Business related travel, training, vacations, and sabbaticals can result in the expert not being available to solve mission critical problems. Global Operations provides redundancy so the local experts can fully enjoy their vacations, training and business trips without any preoccupation that a factory disaster is waiting for them at work when they return.

CONCLUSION

As a natural extension of Copy Exactly, this Global Operations concept is becoming a standard part of Intel's manufacturing strategy and competitive advantage. Global Operations has demonstrated that it is possible to provide effective shared support from remote factories resulting in better operational performance. Global Operations leverages Intel's Copy Exactly synergy, which has enabled Intel to rapidly add global capacity. Local manufacturing downtime incidents, which impact Intel's global capacity, are now being given the appropriate level of global attention. This concept is transforming Intel factories from merely global presence to truly Global Operations!

REFERENCES

[1] G. Gimpelson "Rapid Technology Transfer", Intel iMEC Conference 1998.

[2] E.S. Meieran, "Manufacturing Challenges for the 21st Century", Intel iMEC Conference 1998.

[3] M.A. Fitzharris, "Introduction to IT Staff Retention" Tech Republic, Apr 29, 1999.

[4] C. Pettitt, "FCT Web Optimizes Ramps", Inte

iMEC Conference 1998.